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Indian Standard
SPECIFICATION FOR
CONCRETE FINISHERS

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SPECIFICATION FOR CONCRETE FINISHERS

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(Continued on page 2)

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(Continued from page 1)

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SPECIFICATION FOR CONCRETE FINISHERS

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 8 February 1974, after the draft finalized by the Construction Plant and Machinery Sectional Committee had been approved by the Civil Engineering Division Council.

0.2 Rapid industrialization has necessitated far reaching improvements in the techniques of construction of concrete roads and airfields. Machinery is playing an ever increasing role in the speedy and efficient construction of concrete roads and airfield pavements capable of carrying heavy loads and very high speed traffic and the use of concrete pavers, spreaders and finishers for this purpose is becoming popular. This standard is intended to deal with the essential features of concrete finishers for the guidance of both manufacturers and purchasers. The specifications for concrete pavers and spreaders are covered in IS : 7245-1974* and IS : 7242-1974† respectively.

0.3 Concrete finishers are used immediately after the concrete spreaders in the construction of concrete pavements for finishing, or vibrating and finishing, the concrete already laid and spread by concrete pavers and spreaders.

0.4 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test, shall be rounded off in accordance with IS : 2-1960‡. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard lays down requirements regarding materials, design, construction, capacity and performance for concrete finishers.

2. MATERIALS

2.1 The materials for different components of the finishers shall conform to appropriate requirements of relevant Indian Standards.

*Specification for concrete pavers.

†Specification for concrete spreaders.

‡Rules for rounding off numerical values (revised).

3. SIZE

3.1 The size of the finisher shall be designated by minimum and maximum limits in metres of its operating width.

3.1.1 Common sizes of the finisher shall be:

3 to 4.5 m, and

6 to 7.5 m

3.1.2 Sizes other than those specified above may be supplied by mutual agreement between the purchaser and the manufacturer/supplier.

3.1.3 For all sizes the operating widths of the finisher shall be adjustable by increments of not more than 150 mm.

4. CONSTRUCTION

4.1 General — The finisher shall consist of a steel frame bolted, welded or adequately clamped to end-trucks with power-driven traction wheels, a steering arrangement with clutches and brakes, oscillating front and rear screeds with drive and crown forming mechanisms, a hydraulic system with controls for raising and lowering screeds, and a power unit with a suitable variable reduction drive for controlling the propelling and oscillating mechanisms.

4.1.1 The design of the finisher shall be in accordance with current engineering practice for this type of equipment. Material shall be free from all defects and imperfections that might affect serviceability of the finished product. Load-bearing components of the finisher shall be of such size, material, and strength that the maximum stress imposed through normal operations shall not exceed 65 percent of the yield strength of the material used.

4.2 The various components shall conform to the requirements given in 4.3 to 4.14.

4.3 Chassis — The frame of the finisher shall be of structural steel, constructed as a unit to support the various parts of the finisher which shall be held in alignment during operation or when an adjustment in width is made. The frame shall be adjustable in width and furnished with an operator's platform made of steel with non-skid tread. The adjustment of the frame width shall be accomplished by bolting the end-trucks to the transverse frame members at the required widths or by adjusting telescopic frame members to the required widths. The end-trucks shall be constructed as rigid units so as to hold the traction wheels, drive, and other parts of the trucks in alignment at all times. The transverse frame members and end-trucks shall be so constructed as to prevent excessive deflection of these parts of the

finisher during operation. Pushrollers with suitable brackets, or other acceptable devices, to transmit the thrust from the frame to the screeds when moving forward and snubber bars for dragging the screeds when travelling in reverse shall be provided. Means shall be provided for raising and supporting the frame ends in an elevated position for the purpose of changing wheels. All hydraulic and mechanical controls shall be grouped and located convenient to the operator.

4.4 Traction Wheels — Suitable traction wheels shall be furnished for operation under the following three conditions for finishing concrete slabs:

- a) Between steel forms,
- b) Between steel forms and concrete closure slabs, and
- c) Between two concrete closure slabs.

All wheels shall be mounted outside the end-trucks and shall be capable of quick change-over without disturbing the wheel mounting or drive. Rubber tread wheels shall be provided for riding on concrete slabs. Suitable steel scrapers shall be provided to scrape material from the top of the forms in front of the traction wheels and from the wheels. All wheels shall be power-driven through a suitable reduction drive from the engine transmission, and the wheels on each end-truck shall be controlled independently by a steering arrangement.

4.5 Steering — A steering mechanism shall be provided to permit squaring the finisher with the forms within the full range of grades and curves encountered in paving operations, including curves from a minimum radius of 30 m. The steering mechanism shall be equipped with holding brakes which may be applied to stop or hold the finisher when the traction or power take off are disengaged.

4.6 Screeds — The front and rear screeds shall be of steel construction and shall be adjustable in length to allow finishing of concrete slabs, and be capable of crown adjustment from 0 to 75 mm. The screeds shall be equipped with a quick adjusting mechanism. A graduated crown gauge, visible to the operator, shall show the crown setting. Both front and rear screeds shall be provided with end wings sufficient in size to minimize the spillage of concrete over the road forms. The end wings of the screeds shall be provided with abrasion-resistant steel plates to withstand the wear of sliding friction between screeds and road forms. Both screeds shall be driven from the power unit through a suitable speed reduction mechanism. Screed travel shall be adjustable between 125 to 225 mm. The crank pins attached to the main connecting drive rods shall be equipped with self-aligning roller or ball bearings to provide for normal variations in screed alignment and prevent binding. Both the screeds shall be equipped with a hydraulic lift mechanism mounted in a manner to ensure lifting or lowering both ends of the screed uniformly for a

minimum distance of 75 mm. The lift mechanism consisting of lift levers, pull chains and brackets, shall be connected to a hydraulic system powered from the main engine unit. The lifting mechanisms on both the screeds shall be controlled individually by means of suitable valves.

4.7 Vibrator Attachment — When specified, a vibrator attachment shall be furnished. The vibrator attachment shall be either the submerged or pan type. The vibrator shall be driven by the engine on the finisher; or by separate, mechanical, electric, hydraulic or pneumatic power. Means shall be provided for rapid adjustment for the crown of the pavement, and the expansion of at least 1.5 m in the effective width to conform to like adjustments in the finisher. Provisions shall be made for raising or lowering the vibrators into or onto the concrete.

4.8 Drives

4.8.1 V-belt Drives — Multiple V-belt conforming to IS : 2494-1964* shall be provided.

4.8.2 Chain Drives — Chain drives conforming to IS : 2403-1964† shall be installed with adequate idlers and shall have provisions for adjustment. A mechanical means of lubrication shall be provided for lubricating chains travelling over 105 m/min.

4.9 Control Identification, Safety and Warning Plates — A plate shall be provided for each switch, gauge and control, and at points which require special attention for safe and efficient operation of the finisher. The plates shall be labelled by lettering or other appropriate marking with information as to function, direction the control is to be moved, neutral position, safety instructions, and warnings as necessary. Lettering on the plates shall be not less than 6 mm high and the plates, shall be attached to the finisher in a manner to ensure permanent affixing.

4.10 Power Unit — The finisher shall be powered by a suitable petrol or diesel engine as specified. The power and speed required of the engine to meet the performance requirements of the finisher shall not exceed the net continuous output rating values at which the engine was qualified. The engine shall be furnished complete with accessories as below:

- a) A fuel tank of sufficient capacity for 8 hours rated load operation;
- b) An engine housing;
- c) An electric and manual cranking system;
- d) A generator (with a rating of 18 amperes to 30 amperes);

*Specification for V-belts for industrial purposes.

†Specification for transmission steel roller chains and chain wheels.

- e) External emergency battery-charging equipment; and
- f) An instrument panel with the following instruments:
 - 1) Lubricating oil pressure gauge,
 - 2) Cooling-liquid temperature indicator,
 - 3) Battery-generator indicator,
 - 4) An hour meter, and
 - 5) A fuel level indicator.

4.10.1 Batteries — Unless otherwise specified, the finisher shall be provided with batteries conforming to IS : 985-1962*.

4.10.2 Battery Box — The finisher shall be provided with a weatherproof battery box made of steel sheet not less than 2.0 mm thick. The box shall be designed for the battery size specified; it shall be vented at the top, and shall be provided with a drain in the bottom. Means for retaining the battery in the box shall be provided. The retaining device shall be constructed to that pressure shall be applied only on the outer edges of the battery case. When the battery is installed in the box, with all electrical connections completed, and with the battery box lid in the closed position, there shall be no uninsulated electrical conductor within 25 mm of any point at which an electrical potential exists within the battery box. The box shall be located so that the battery will be accessible for routine maintenance, removal, and replacement. The battery electrolyte level shall be visible when the battery filler caps are removed. It shall be possible to service the battery with conventional battery servicing aids, such as a hydrometer and syringe. Grommets shall be provided to protect the battery lead cables where the cables pass through the box. All interior surfaces of the box shall be painted with acid-resistant paint.

4.11 Power Transmission — Transmission of power from the engine shall be accomplished by mechanical, electrical, or hydraulic means. When a mechanical transmission is furnished, it shall be of the selective gear type, fully enclosed with gears running in oil, and all shafts mounted on anti-friction bearings. All operating levers shall be grouped within easy reach of the operator, and lever positions shall be plainly marked.

4.11.1 The finisher shall be provided with not less than four traction speeds in both forward and reverse, and not less than three screed speeds with engine running at governed speed. The traction speeds shall cover a range 0 to 15 m/min. The screed speeds shall cover a range from 0 stroke per minute to not less than 30 strokes per minute. The operation of the screeds shall be independent of the traction.

*Specification for lead-acid storage batteries (heavy duty) for motor vehicles (revised).

4.11.2 Clutch — The engine shall be connected to the transmission through a manually operated clutch of the disc type. Clutch shall be capable of transmitting not less than 130 percent of the maximum torque developed by the engine.

4.12 Hydraulic System — The hydraulic system shall include a hydraulic pump with suitable drive, a tank and valve unit equipped with a pressure relief valve, valve control levers, pressure gauge, suction and pressure lines with fittings and connections, lifting rams, and double-acting cylinders, and brackets for mounting the various parts. The hydraulic system shall be so arranged that the valve control levers will be located conveniently for the operator.

4.13 Lifting Attachments — When specified, the finisher shall be provided with suitable lifting attachments to enable it being lifted in its normal position. The attachments shall be located so that, when hoisted, adequate clearance will exist between lifting slings and all exterior parts of the equipment. When practicable, one attachment of sufficient capacity to carry at least 500 percent of the total lifted weight shall be used. When two or more slings are used, each attachment shall be of sufficient capacity to carry at least 250 percent of the weight being lifted. The attachments for multiple slings shall be designed so that the attached slings will converge at a point not to exceed 5.5 m above the lowest extremity of the load, when such limitation is possible. Lifting attachments shall be positioned in such direction that the lifting strain will be in line with the longitudinal axis (peripheral plane) of the eye of the attachment. The eye of each lifting attachment shall be not less than 75 mm inside diameter. The members to which eyes are attached shall be of sufficient strength to withstand stresses in the amount and direction of pull specified for the pad eye.

4.13.1 Where required, suitable reinforcements shall be used to meet the requirements specified herein. Some examples of such reinforcements are:

- a) Flat lifting pads shall be bent around the equipment member to give a 90 degree effect and in such manner as to bear against the equipment surfaces opposite to the direction of pull. Where it is not practicable to bend the pad around the equipment, a bolt or bolts of sufficient capacity shall pass through the pad and equipment member. In all cases, the pad shall be welded to the equipment member.
- b) Round stock pad eyes shall be bent around the equipment member in such manner as to bear against the equipment surfaces opposite to the direction of pull and shall be welded to the equipment. Where this is not practicable, the round stock shall be threaded and passed through the member and be bolted and welded on both sides of the members.

4.13.2 A diagram showing the lifting attachments and lifting slings shall be inscribed on a copper-base alloy plate securely fastened to the unit with the lifting capacity of each attachment and the required length and size of each sling cable marked thereon. A silhouette of the equipment showing the centre of gravity shall be provided.

4.14 Tiedown Devices — When specified, the finisher shall be provided with suitable, permanently attached devices to permit tiedown of the finisher to the floor or deck of the transportation vehicle. The tiedown devices shall be of such design, locations, and number as to enable the finisher to be anchored in such manner as to prevent shifting or movement in any direction. The devices shall be designed to withstand thrusts of the following magnitude:

- Forward thrust — $8G^*$,
- Rearward thrust — $8G^*$,
- Upward thrust — $2\frac{1}{4} G$, and
- Sideward thrust — $1\frac{1}{2} G$.

The tiedown devices shall be located so as to permit easy attachment of cables or turn buckles. Tiedown devices shall be indicated by a suitable information plate, by stencilling or other suitable marking of the finisher. The marking shall clearly indicate that the device is intended for tiedown of the finisher on the carrier when transported. Tiedown devices may also be used as lifting attachments if they meet the requirements for lifting attachments specified in 4.13.

5. WORKMANSHIP

5.1 Steel Fabrication — Steel used in the fabrication of equipment shall be free from kinks and sharp bends. The straightening of material shall be done by methods that will not cause injury to the metal. Shearing and chipping shall be done neatly and accurately. Corners shall be square and true. Flame cutting, using a tip suitable for the thickness of metal, may be employed instead of shearing or sawing. Re-entrant cuts shall be made in the best possible manner. All bends of a major character shall be made with controlled means in order to ensure uniformity of size and shape. Precautions shall be taken to avoid overheating, and heated metal shall be allowed to cool slowly.

5.2 Bolted Connections — Bolt holes shall be accurately punched or drilled and shall have the burrs removed. Washers or lockwashers shall be provided in accordance with good trade practice, and all bolts, nuts, and screws shall be tight.

*G = Cargo weight of unit.

5.3 Riveted Connections — Rivet holes shall be accurately punched or drilled and shall have the burrs removed. Rivets shall be driven with pressure tools and shall completely fill the holes. Rivet heads, when not countersunk or flattened, shall be of approved shape and of uniform size for the same diameter of rivet. Rivet heads shall be full, neatly made, concentric with the rivet holes, and in full contact with the surface of the member.

5.4 Welding — The surface of parts to be welded shall be free from rust, scale, paint, grease, or other foreign matter. Spot, tack, or intermittent welds for strength will not be permitted. Weld penetration shall be such as to provide transference of maximum design stress through the base metal juncture. Fillet welds shall be provided when necessary to reduce stress concentration.

5.5 Machine Work — Tolerances and gauges for metal fits shall conform to the limitations specified herein and on the applicable drawings, and otherwise to the standards of good trade practice.

5.6 Castings — Castings shall be sound and free from patching, misplaced coring, warping, or other defects which might render the casting unsound for use.

6. EASE OF MAINTENANCE

6.1 The finisher shall permit accessibility to all parts for maintenance and repair, utilizing common tools associated with equipment of this nature. The replacement and adjustment of parts shall be accomplished with a minimum disturbance to other components. Components, such as the radiator, liquid cooled engine, oil reservoir, crank case and other parts containing liquids shall be provided with an accessible means for draining. The drains shall be located so that the contents of the respective compartments will drain directly into a receptacle.

7. INTERCHANGEABILITY

7.1 All replaceable parts shall be manufactured to definite standards, clearances, and tolerances in order that any such parts of a particular type or model having the same functional and performance characteristics can be replaced or adjusted without requiring modification. When practicable, all such parts shall be permanently and legibly marked with the manufacturer's part number.

8. FINISHING

8.1 All exposed parts of the finisher shall be cleaned, treated and painted with suitable anticorrosive protective paint.

8.2 Fungus Resistance — When specified, electrical connections including terminal and circuit connections, components, and circuit elements shall be

coated with varnish except that:

- a) components and elements inherently inert to fungi or which are hermetically sealed need not be treated, and
- b) components and elements where operation will be adversely affected by the application of varnish shall not be treated.

9. LUBRICATION

9.1 Means for lubrication shall be provided for all moving parts requiring lubrication. All lubrication fittings shall be accessible to a hand grease gun. Pressure lubrication fittings shall not be used where normal lubricating pressure may damage grease seals or other parts. The finisher shall be lubricated prior to delivery with suitable lubricants designed for use in the specified temperature range. The finisher shall be conspicuously tagged to identify the lubricants and their temperature range.

9.2 Enclosures with Internal Reservoir of Lubricant — Enclosures, such as gear cases and transmission housings, which contain a reservoir of lubricants for the lubrication of the parts enclosed shall be equipped with dip sticks, finger holes or sight holes to determine the level of the lubricant. Such enclosures shall be equipped with a permanent magnetic type drain plug. Each enclosure shall be equipped with a means for fitting the enclosure with lubricant. The drain plug shall be located so that removal of the plug will result in complete drainage of the lubricant from the enclosure. Drainage shall be to the ground when the equipment is in its normal position. Integral tubes or troughs may be used to convey the lubricant from the drain to the ground. Accessibility to the drain plug, the filling means, and the lubricant level checking device shall be obtained without the removal or adjustment of accessories or parts. Engine housing side panels and plates equipped with hand operable, quick-disconnect fasteners may be used.

10. SAFETY REQUIREMENTS

10.1 All rotating or reciprocating parts and all parts subject to high operational temperatures, that are of such nature or are located as to be or become a hazard to operating or attending personnel, shall be adequately guarded or insulated to the extent necessary to eliminate the hazard. Suitably located non-skid steel plate with non-skid tread or abrasive surfaces or sturdy wood walkways shall be furnished to provide access from either side of the finisher to the operating position.

11. REPAIR PARTS, MAINTENANCE TOOLS, AND ACCESSORIES

11.1 Such repair parts, maintenance tools, and accessories as are specified shall be furnished. A manual of instructions for maintenance and an illustrated list of spare parts required for replacement shall also be furnished.

11.2 Toolbox — The toolbox shall be made of metal not less than 2 mm in nominal thickness. The toolbox shall be complete with trunk drawbolt and a lid which shall open not less than 90 degrees. The drawbolt shall be of a type that will keep the lid closed when subjected to vibration or rough travel. The toolbox shall be securely fastened to the finisher, and shall be of sufficient size to hold the tools specified.

12. INSTRUCTION PLATES

12.1 Each finisher shall be equipped with instruction plates, including warnings and cautions suitably located, describing any special or important procedure to be followed in operating and servicing the finisher. Plates shall be of the copper base alloy.

13. TRANSPORT WHEELS

13.1 If so desired by the purchaser the finisher shall be furnished with not less than two hydraulically retractable, pneumatic-tyred transport wheels. A towing arrangement shall be furnished with a 75 mm inside diameter lunette eye and shall enable the finisher to be towed by vehicles having a pintle height of 700 to 850 mm.

14. PERFORMANCE

14.1 The finisher, when furnished without a vibrator attachment, shall be suitable for use in construction of concrete roads, and shall satisfactorily and speedily surface previbrated concrete slabs, 6 to 7.5 m wide, built of gravel or crushed-stone concrete, with a slump as low as 25 mm. When furnished with a vibrator attachment, it shall have the same performance on non-previbrated concrete slabs. The finisher shall be equipped to finish concrete slabs installed under the specified conditions (*see 4.4*). Demountable rims may be furnished; when furnished, the rims shall be easily removable without removing wheels. All wheels shall be power driven.

15. PARTICULARS TO BE SUPPLIED BY THE PURCHASER

15.1 The purchaser shall furnish the following particulars to the manufacturer or supplier while ordering:

- a) Working widths and variation in widths,
- b) Output per hour,
- c) Whether vibrator attachment is required,
- d) Whether fungus resistance is required,
- e) Whether lifting attachments and tiedown devices are required,

- f) Whether required to be operated at high altitudes,
- g) Whether required to be dismantled with transport packs,
- h) Type of control, hydraulic or mechanical, and
- j) Whether the power unit shall be compression ignition type (diesel) or spark ignition type (petrol), and
- k) Any other special requirements.

16. MARKING

16.1 Each machine shall have an identification plate permanently affixed to it with the following particulars conspicuously marked on it:

- a) Manufacturer's name or trade-mark,
- b) Manufacturer's reference number of the machine,
- c) Size of the machine,
- d) Gross weight of machine,
- e) Rating of the power unit, and
- f) Year of manufacture.

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